

REMARKS

Claims 1, 7, 11 and 19 have been amended. Claims 1 to 12 and 19 to 25 remain active in this application and withdrawn claims 13 to 18 have been canceled.

The objection to the specification in paragraph 4 of the Office action is not understood. Attorney for applicants is unable to find an amendment to the specification in the paper filed August 14, 2003. Furthermore, as noted in the specification in the paragraph bridging pages 12 and 13, it is clear that the thickness of the copper stud is at least ten times greater than the thickness of the copper layer since the ratio of 0.3 to 0.8 is more than one tenth of 10 to 20. It follows that the ratio is supported by the disclosure as originally filed.

Claims 19 to 25 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite. The rejection is respectfully traversed for reasons stated in the above paragraph relating to the objection to the specification.

Claims 1 to 4, 6 and 9 to 11 were rejected under 35 U.S.C. 102(b) as being anticipated by Kondo et al. (U.S. 5,656,969). The rejection is respectfully traversed.

Claim 1 requires, among other features, a metal structure for a contact pad of an integrated circuit having copper interconnecting metallization protected by an overcoat. No such structure is taught or suggested by Kondo et al. either alone or in the combination as claimed. The contact pad of Kondo et al. is aluminum and the copper of Kondo et al. is not interconnecting metallization, but rather a seed for the formation of the bump 108.

Claim 1 further requires that a portion of the copper metallization be exposed by a window in the overcoat, not shown in Kondo et al.; that the exposed copper having a clean surface, not shown in Kondo et al. and that the window having a perimeter, not shown in Kondo et al.

Claim 1 still further requires a *patterned* copper layer positioned directly on the clean copper metallization, the metal structure having an electrical conductivity about equal to the electrical conductivity of pure copper, the copper layer overlapping the perimeter of the overcoat window. No such structure is taught or suggested by Kondo et al. either alone or in the combination as claimed.

Claim 1 yet further requires a copper stud positioned directly on the copper layer, following the contours of the copper layer. No such structure is taught or suggested by Kondo et al. in the combination as claimed.

With reference to the allegation that claim 1 is a product by process claim, this allegation is respectfully traversed. A clean surface is a structural limitation. Patterned copper is a structural limitation as is clean copper metallization.

Claims 2 to 4, 6, 9 and 10 depend from claim 1 and therefore define patentably over Kondo et al. for at least the reasons presented above with reference to claim 1.

Claim 2 further limits claim 1 by requiring that the clean copper surface be free of copper oxide, organic residues, and contamination. No such requirement is taught or suggested by Kondo et al. The allegation as to product by process is treated above with reference to claim 1.

Claim 3 further limits claim 1 by requiring that the direct positioning of the copper layer on the clean copper pad provide the lowest possible electrical resistance and relinquish the need for an intermediate barrier or under-bump layer. No such combination is taught or suggested by Kondo et al.

Claim 4 further limits claim 1 by requiring that the copper layer have a thickness in the range from about 0.3 to 0.8 μm . No such combination is taught or suggested by Kondo et al.

Claim 6 further limits claim 5 by requiring that the inorganic layer form a perimeter around the window having a slope coverable by said copper layer. No window is shown in Kondo et al. Accordingly, not only is it not understood how claim 6 can be rejected based upon section 102 when the broader claim from which it depends is not so rejected, but, furthermore, this feature is not taught or suggested by Kondo et al. either alone or in the combination as claimed.

Claim 11 requires, among other features, metallurgical connections between solder bumps and contact pads positioned on integrated circuits having copper interconnecting metallization protected by an overcoat. No such structure is taught or suggested by Kondo et al.

Claim 11 further requires that a portion of the copper metallization be exposed by a window in the overcoat. No such structure is taught or suggested by Kondo et al. either alone or in the combination as claimed.

Claim 11 still further requires that the exposed copper have a clean surface. No such requirement is taught or suggested by Kondo et al.

Claim 11 yet further requires a patterned copper layer directly positioned on the clean copper metallization; the metal structure having an electrical conductivity about equal to the conductivity of pure copper, the layer overlapping the perimeter of the overcoat window. No such structure is taught or suggested by Kondo et al. either alone or in the combination as claimed.

With reference to the allegation as to any of the claims herein being product by process, the argument presented above with reference to claim 1 applies to all of the claims. Furthermore, even if there be a process limitation in a structure claim, the claim remains a structure claim with the process limitation having no weight.

Claim 5 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. in view of Edelstein et al. (U.S. 6,133,136). The rejection is respectfully traversed.

Claim 5 depends from claim 1 and therefore defines patentably over the applied references since Edelstein et al. fails to overcome the deficiencies in Kondo et al. as noted above.

In addition, claim 5 further limits claim 1 by requiring that the overcoat be a moisture-impermeable inorganic layer including silicon nitride and silicon oxynitride of approximately 1.0 μm thickness. No such structure is taught or suggested by Kondo et al. Furthermore, there is no teaching or suggestion to combine Kondo et al. with Edelstein et al. even were the combination to teach or suggest the claimed invention, which it does not as demonstrated above.

Claim 7 and 8 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. in view of Applicants' Prior Art (APA) further in view of Gansäuge et al. (U.S. 5,010,389). The rejection is respectfully traversed.

Claims 7 and 8 depend from claim 1 and therefore define patentably over the applied references for at least the reasons presented above with reference to claim 1 since neither APA nor Gansauge et al. overcome the deficiencies in Kondo et al. as noted above.

In addition, claim 7 further limits claim 1 by requiring that the overcoat be a sequence of an inorganic layer adjacent to the integrated circuit, overlaid by a polymeric layer including polyimide, benzocyclobutene, and polybenzoxazole of approximately 3.0 to 10.0 μm thickness, capable of absorbing thermomechanical stress. No such combination is taught or suggested by Kondo et al., APA or Gansauge et al., either alone or in any proper combination. Furthermore, as noted above, there is no inorganic overcoat as claimed in Kondo et al. Accordingly, there is no teaching or suggestion to add such a feature to Kondo et al. other than from the subject disclosure.

Claim 8 further limits claim 7 by requiring that the sequence of layers form a perimeter around the window having a slope coverable by the copper layer. Since there is no window in Kondo et al., no such feature is taught or suggested by any proper combination of the applied references either alone or in the combination as claimed.

Claim 12 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. in view of Huang (U.S. 2002/0096764). The rejection is respectfully traversed.

Claim 12 depends from claim 11 and therefore defines patentably over the applied references for at least the reasons presented above with reference to claim 11 since Huang fails to overcome the deficiencies in Kondo et al. as demonstrated above.

In addition, claim 12 further limits claim 11 by requiring that the solder bumps be selected from a group consisting of tin, indium, tin/lead, tin/indium, tin/silver, tin/bismuth, conductive adhesives, and z-axis conductive materials. No such combination is taught or suggested by Kondo et al., Huang or any proper combination of these references.

Claims 19 to 22, 24 and 25 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. The rejection is respectfully traversed.

Claim 19 requires, among other features, an integrated circuit having copper interconnecting metallization protected by an overcoat. No such structure is taught or suggested by Kondo et al. either alone or in the combination as claimed.

Claim 19 further requires that a portion of the copper metallization be exposed by a window in the overcoat. No such structure is taught or suggested by Kondo et al. either alone or in the combination as claimed.

Claim 19 further requires a patterned copper layer directly positioned on the exposed clean copper metallization, the metal layer overlapping the perimeter of the overcoat window. No such structure is taught or suggested by Kondo et al. either alone or in the combination as claimed.

Claims 20 to 22, 24 and 25 depend from claim 19 and therefore define patentably over Kondo et al. for at least the reasons presented above with reference to claim 19.

In addition, claim 20 further limits claim 19 by requiring that the copper layer have a thickness in the range from about 0.3 to 0.8 μm . No such combination is taught or suggested by Kondo et al.

Claim 21 further limits claim 19 by requiring that the overcoat be a layer comprising silicon nitride. No such combination is taught or suggested by Kondo et al. either alone or in the combination as claimed.

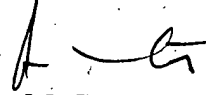
Claim 22 further limits claim 19 by requiring that the window in the overcoat has sloped sides. No such combination is taught or suggested by Kondo et al.

Claim 24 further limits claim 19 by requiring that the copper layer follow the contour of said perimeter of the overcoat window. No such combination is taught or suggested by Kondo et al.

Claim 25 further limits claim 19 by requiring that the copper stud have a thickness in the range from about 10 to 20 μm . No such combination is taught or suggested by Kondo et al.

In view of the above remarks, favorable reconsideration and allowance are respectfully requested.

Respectfully submitted,



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